An Evaluation Framework
Incorporating User Interface Accessibility

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Abstract
As computer technologies rapidly evolve, evaluation as an integral part of the development lifecycle of complex systems and user interfaces (UIs), which address diverse user groups including people with disability, emerge as critical to their success. Typically though, traditional evaluation methods and techniques originally developed for conducting conventional UI usability evaluations (e.g., of GUIs) are usually introduced in late development stages of such UIs and adapted on a case-by-case basis. Reportedly, such non-systematic approaches to evaluation are often proved inefficient and ineffective in assessing the accessibility or other qualities - such as the utility and usability - of systems that are (also) targeted to a diverse user population. This paper presents a normative framework for evaluation that allows to address additional system qualities such as visibility-findability, perceived usefulness prior access and use, availability-approachability, interaction qualities (e.g., accessibility, utility and usability), and user relationship maintainability. The proposed model can be employed both in evaluating an individual system and in comparing / assessing sets of systems. Furthermore, the same model can apply also at the level of subsystems and system functions. A significant advantage of the proposed framework is that it can be employed for evaluations that need to pay attention also to substantial factors that are usually neglected. These include accessibility, the needs and requirements of a more diverse user population, and variances in user patterns as these evolve in the context of repeated and long term usage. In particular, the framework can be employed in the evaluation both of systems that are aimed to offer accessibility and usability to all, including people with disability, as well as of systems that are specifically developed for people with disability.

1 Introduction
As nowadays computer technology is transcending into an empowering expression and communication medium with an increasing pervasiveness in the entire sphere of human activities (work, leisure time, entertainment, education and training, etc.), numerous opportunities and challenges emerge for the population at large. The potential benefits are clear: accessible, fast, cheap, personalized and efficient information and service delivery for all, including people with different cultural, educational, training, and employment background, novice or experienced users, the very young and the elderly, and people with different types of disabilities. However, exploiting those benefits and realizing the collective vision of an Information Society for All, has proven somewhat elusive, especially in terms of accessibility where progress is made slowly. This is mainly due to the limited availability of appropriate guidance and best practice knowledge for building high-quality user interfaces (UIs), accessible and usable by a diverse user population with different abilities, skills, requirements, and preferences. As a result, appropriate evaluation processes, as an integral part of the development lifecycle, become critical to their success. However, despite the numerous cases that report results of studies which concern people with disability, little attention has been paid on the actual process of conducting evaluations for, diverse user groups, including disabled users. Typically, traditional evaluation methods and techniques originally developed for conducting conventional UI usability evaluations (e.g., of GUIs) are introduced in late development stages of UIs for people with disability and adapted on a case-by-case basis (e.g., Becker & Lundman, 1998). Reportedly, such non-systematic approaches to evaluation are often proved inefficient and ineffective in assessing accessibility or other qualities - such as utility and usability - of systems that are targeted to a diverse user population.
This paper argues that the evaluation of UIs for diverse user groups, including people with disability, requires more rigorous methods and more systematic approaches. An analysis of the involved sources of variability and other related issues reveals the necessity for adopting more comprehensive evaluation methodologies that address additional system qualities such as visibility-findability, perceived usefulness prior access and use, availability-approachability, interaction qualities (e.g., accessibility, utility and usability), and user relationship maintainability. A line of work in this direction is currently being conducted by the authors in the context of the EU funded Project eUSER (see Acknowledgments section) and a preliminary normative model of user experience lifecycle has been elaborated as a conceptual framework for the delivery of user-centered eServices. This model, which incorporates accessibility as a basic determinant of acceptability and long-term adoption of interactive technologies, is generic and is claimed to apply to all types of (computer) products and services, including universally accessible systems as well as systems especially developed for people with disability. The work presented in this paper builds upon and extends such a user experience lifecycle model in order to provide an evaluation framework for UIs targeted to various user groups, and for taking into account accessibility.

2 Background

From the moment the World Wide Web (WWW) has made clear its real powers, such as its universality, governments and other providers all around the world began outlining their visions for the online delivery of services. For instance, among the main objectives underlining the eEurope 2005 action plan stands the vision of making “modern online public services”, such as eGovernment, eHealth and eLearning, available to all citizens. Despite significant efforts worldwide, reportedly (e.g., see Accenture, 2002), the realisation of the eServices vision has proven hard, and the offered systems show controversial degrees of success. There is now a growing recognition that the success of eServices, just like other software applications, does not rely solely on technology. Simply moving a service online has proven problematic. According to collective mindset change, ultimately, both organisation processes and their eServices need to be appropriately (re-) designed in order to put the user, citizen or business, at the centre (Accenture, 2002). In this direction, the current Information Society Technologies (IST) programme has been strategically aligned with the eEurope 2005 action plan in order to “...reinforce and complement the eEurope 2005 objectives and look beyond them to the 2010 goals of the Union of bringing IST applications and services to everyone, every home, every school and to all businesses”.

Currently both practitioners and researchers have a strong interest in understanding why people resist using computers, in order to develop better methods for designing technology, for evaluating systems and for predicting how users will respond to new technology (Gould, Boies & Lewis, 1991). Previous research has identified a number of reasons why ‘customers’ use, or do not use, computer systems. Usability, for instance, has long been considered by the scientific community and practitioners as a salient system adoption factor. Actually, the term usability (as ease of use) was first introduced, and its importance recognised, long time before the appearance of computer systems and digital technologies. Back in 1842, De Quincey (1842) argued that “it is not the utility, but the usability of a thing which is in question”. Nevertheless, it is nowadays commonly perceived that optimising utility and usability alone, although certainly a high priority, does not necessarily mean that take-up rates of a system will reach their full potential. There is another key determinant of system adoption by its target users that is not stressed out in common perspectives; that of accessibility, which can be considered as a necessary prerequisite for usability, since there may not be optimal interaction if there is not the possibility of interaction in the first place. Similarly, other important factors in this respect include, but are not limited to, findability and affordability. Findability refers to the ease or difficulty that (potential) users have in finding the type of system that they are interested in, i.e., the degree to which target users are aware and informed about the existence of system in question, and about how to locate it. Affordability refers to the degree to which potential users can afford the cost to access and use a product or service.

The eUSER project (IST-507180) is aimed at putting the user and user needs at the centre of the development of electronic services. The focus of the project has been placed on the needs of citizens as users of online public services in their interactions with public administrations, in the management of their health and in furthering their education and developing their skills. In this context, a major concern is to support better practice both in addressing generic user issues that apply across the user population (generic principles of customer service orientation, user involvement, good design, usability), and in addressing the diversity of specific user issues that arise for particular sub-groups (for example, preferences for delivery platforms and modes of interaction, linguistic requirements, varying levels of online experience and skills, accessibility requirements arising because of disability). The research work conducted in the context of the eUSER project has aimed at identifying and cross-referencing user issues and
service characteristics in relation to online services. In this direction, a thorough review of the related literature was conducted and a conceptual framework was proposed (eUSER, 2004) for specifying the various characteristics of eServices that may affect the degree to which population at large will adopt them. Building on this framework, an inspection method for assessing the user-orientedness of eServices is currently being elaborated.

3 Related Work

Related work concerns established models and frameworks for the evaluation of computer systems and UIs in general. Such models and frameworks mainly focus on usability and acceptability of products and services, and do not appropriately incorporate the accessibility dimension.

3.1 System Usability and Acceptability

The term ‘system acceptability’ has been introduced by Nielsen (1993) as a means to analyse the system qualities that impede or foster its overall acceptability. According to Nielsen (ibid), the overall acceptability of a computer system depends on “whether the system is good enough to satisfy all the needs and requirements of the users and other potential stakeholders, such as users’ clients and managers”. In these terms and further to Nielsen, a system’s acceptability is a combination of its social acceptability and its practical acceptability, where social acceptability refers to how well a system complies with societal needs (such as ethics, legality, etc.), and practical acceptability is determined by its (practical) usefulness and a number of more traditional attributes, such cost, support, compatibility with existing systems, reliability, etc. The usefulness of a system, as the issue of whether its use can help in achieving some desired goal(s), can be broken down into utility and usability (Grudin, 1992): utility determines in principle whether the functionality of the system can do what is needed, and usability applies to all aspects of a system with which a user may interact (including installation and maintenance procedures) and is a question of how well users can use that functionality. Then Nielsen (1993) breaks down usability into the following components: learnability, efficiency, memorability, errors, and satisfaction.

Building on the numerous approaches in bibliography to define usability, in ISO 9241 (1998) usability is defined as: “The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” The same ISO standard provided a more evolved framework for specifying and measuring the usability of products. According to this framework:

- Usability is measured by the extent to which the intended goals of users are achieved (effectiveness), the resources that have been expended to achieve these goals (efficiency) and the extent to which the users find the use of the product acceptable (satisfaction).
- Emphasis is given to the context of use and to the fact that the level usability depends on the specific circumstances in which the product is used.

The proposed framework consists of three components: (a) the context of use (the users, the equipment, the environment, the goals & the tasks); (b) the usability measures (effectiveness, efficiency and satisfaction); and (c) the users’ goals of use of the product.

3.2 User Acceptance of Technology

Current models of technology acceptance have their roots in a number of diverse theoretical perspectives. One of the most popular among them is that of the Innovation Diffusion Theory (Tornatzky & Klein, 1982; Rogers, 1983; Moore & Benbasat, 1991) which seeks to identify significant perceived characteristics of technology which may influence its adoption by users. On the other side, in social psychological research, theorists seek to identify determinants of behaviour within the individual rather than the technology. The Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) has been used to investigate how user beliefs and attitudes are related to individual intentions to perform. TRA provides a complete rationale for the flow of causality from external stimuli (such as system design features) through user perceptions to attitudes about the technology, and finally to actual usage behaviour (ibid).
Acceptance theory seeks to extend the traditional model of user-centred design espoused in usability engineering approaches from issues of UI improvement towards predictions of likely usage, i.e., to change emphasis from “can people use a system?”, to “will people use a system?”. The Technology Acceptance Model (TAM) of Davis (1989) is derived from TRA. TAM was designed to gather evaluative measures of information system quality and suitability to job requirements, and thereby enable predictions of acceptance and usage. Davis wrote “The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations” (Davis, Bagozzi, & Warshaw, 1989). TAM predicts user acceptance based on the influence of two factors: perceived usefulness and perceived ease of use. Perceived usefulness is “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis 1989). The author applies the notion to work contexts only, but it may also be used for non-work related activities. In this case we might talk about “enhancing his or her quality of life” rather than about job performance. Perceived ease of use is “the degree to which a person believes that using a particular system would be free of effort” (ibid). TAM posits that user perceptions of usefulness and ease of use determine attitudes toward using the system. Consistent with TRA, behavioural intentions to use are shown to be determined by these attitudes toward using the system. According to the model, behavioural intentions to use determine in turn actual system use. In addition, a direct relationship between perceived usefulness and behavioural intentions to use is also proposed by TAM. According to Morris and Dillon (1997), TAM can potentially offer HCI professionals a theoretically grounded approach to the study of software acceptability that can be directly coupled to usability evaluations. Actually, TAM has been utilised in many online contexts to gauge user perceptions of system use, and the probability of adopting an online system (e.g., Gefen & Straub, 2000; Pavlou, 2001,).

Newer approaches have tried to extend TAM in order to integrate other constructs (e.g., Pavlou 2001; Fetherman & Pavlou, 2003;). Such an identified determinant is perceived risk (PR), as an uncertainty regarding possible negative consequences of using a product or service. In Featherman and Pavlou (2003) the authors propose that PR comprises the facets of: performance, financial, time, psychological, social, privacy and overall risk.

When measuring user satisfaction as a key determinant for user acceptance, we need to be aware of the fact that satisfaction is heavily influenced by expectations. In other words, perceptions of service quality stem from a comparison of what customers feel a provider should offer (i.e., their expectations) with the way the service is actually delivered. In MORI (2002), the authors suggest a list of factors that influence expectations: previous experience, personal needs, implicit service communication, values and beliefs, views about the provider, explicit service communication, word-of-mouth communication.

4 Synthesis and enhancement: a model of the user experience life-cycle

In the development of the proposed approach, the aforementioned models and perspectives were reconsidered by putting the emphasis on the user’s decision making process (and the involved determinants) towards the use and adoption of a system. The main generic perspective looks at the process of discovering, identifying the need or interest to use, reaching (i.e., accessing), using and re-using or not a system (see Figure 1). Decisions along these steps are taken on the basis of perceived service characteristics rather than actual, “objective” characteristics. This is very important, as perceived features can diverge significantly from measurable characteristics, as Zeithaml et al. (2001) have shown. A typical example of this phenomenon is the area of “real” security features and the feeling of trust in the security of a system that is delivering the service in question.

In employing the proposed framework for evaluations, a careful consideration of the user’s behavioural situation / intention is required at each phase of the lifecycle. In order to be able to determine whether a user will move from one phase to subsequent one, a careful study of the actual characteristics of the system need to be examined in correlation with the user’s expectations and context of use. In this way, one can assess / estimate what are or could be the characteristics and qualities perceived from the end-user and which act as critical determinants for proceeding to a subsequent phase of the lifecycle. For instance, each time a user wishes to reuse a system, as a first step he or she (re)attempts to reach the system. In order to move to the subsequent step, which is to actually use the system, the user reassesses the ease of reaching the system based on the expectations built-up up to that stage. Clearly, in each new attempt the expectations regarding the system may vary, e.g., due to the previous experience with the system (see Section 6).
The user experience lifecycle model can be used to predict (or assess) the acceptability of a system, where acceptability can be considered as the potential of the system to be accepted by its target users. The likelihood that a system is acceptable by its users can be explored by checking users’ behavioural situation / intention at each of the following stages:

- Becoming aware of the system and its objectives (i.e., the person becomes aware of the system’s existence and preliminary expectations are formed).
- Being motivated to gain a personal experience of the system (the person by assessing the perceived usefulness and ease of access and use of the system is persuaded to try out the system – at this stage perceived risks and other external variables such as expectations are also taken into consideration).
- Attempting to reach the system (the person manages to reach the system in an acceptable fashion according to his/her expectations and regardless of disability, skills, etc.).
- Attempting to use the system (i.e., the person manages to use the system in an acceptable fashion according to his/her expectations and regardless of disability, skills, etc.).
- Being offered a more satisfying alternative (in order to figure out if one is likely to become a faithful user).
- Being motivated to reuse (i.e., the person has been persuaded to use the system again).

Note that there are certain systems where users are not necessarily ‘likely to use the system again’ even if they are fully satisfied after initial goal fulfilment (e.g., trial versions, emergency health services, enrolment at a university). Nevertheless, not only their positive experience can make them potentially faithful to the system provider (which means positive attitude to -and higher expectations from- other products from the same provider), but they may also contribute to the system’s publicity.
The basic categories of a system’s characteristics of relevance to the user experience lifecycle are (adapted from eUSER, 2004):

- **Visibility** means the degree to which a system is known to potential users. Visibility can partly be influenced and managed by providers through publicity strategies. Products can, however, be visible to a certain degree even if no promotion has taken place. Awareness might result from unintentionally coming across a service, e.g. while surfing on the Internet. This relates to the definition of findability used in the context of website promotion strategies, which can be structured to a variable degree.

- **Perceived usefulness and ease of use** refer to the usefulness and ease of use of the service from the viewpoint of the individual (actual or potential) end user. They might be derived from the relevance of the product to meet particular needs of the user and the suitability for personal circumstances. It also comprises the variety of tangible aspects, such as time and cost savings resulting from the service itself (rather than the way it is delivered). Finally, it can also incorporate less tangible aspects, such as personal intrinsic gratification that can be derived from the fun of, for example, participating in an attractive learning experience/training course. Other social aspects may also play a role such as prestige and social desirability. All such aspects are considered in the form of perceived risks and user expectations.

- **Availability / Approachability** refers to the degree to which the distribution channels and technologies employed allow all types of potential users to approach the product in question e.g., anyone, at any time, from anywhere. At this stage, particular needs and requirements of diverse user populations such as people with disability are considered with regards to options offered for reaching the system.

- **Quality of usage experience** encompasses the quality of use of the system and its ability to fulfil the goals and expectations of the user (i.e., lead to subjective satisfaction). Accessibility of the UI of a system is one of the main determinants of the quality of usage experience (see section 5).

- **Relationship maintainability** is the degree to which a good relationship between the user and a system is effectively maintained while the user is not working on the system, e.g., by means of informing the user for new functionality, content updates, etc.

## 4.1 Transcending from acceptable to ‘adoptable’ systems

Increase of the quality and acceptability of a system can be reflected from an increase of the ease with which people move from the “Non user” state to the “Potentially Faithful User” one, and / or a decrease of the possibilities of losing users trough the “Offered a more satisfying alternative” case (e.g., obtained through redesign). In these terms, the model can be slightly modified to introduce a paradigm shift from meeting “acceptance” levels to meeting higher levels of “user will for adoption” (i.e., more competitive levels), and from “Potentially Faithful Users” to “Likely faithful Users” respectively. In this case, the decision process is based on whether the user manages to reach and use the system, not simply acceptably, but in a competitive and empowering manner - thus transcending from an acceptable to an ‘adoptable’ system.

ISO 8402 (1994) defines quality as “the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs”. Garvin (1984) distinguishes between five overall approaches to defining quality. A traditional view is that quality is transcendent: a simple un-analyzable property which is recognised through experience. Although the term quality often raises this pre-conception, it is an ideal view which does not provide any indication of how quality can be achieved in practice.

Garvin (ibid) distinguishes four other practical approaches to quality:

- **Product quality**: “an inherent characteristic of the product determined by the presence or absence of measurable product attributes”.

- **Manufacturing quality**: “a product that conforms to specified requirements”.

- **User perceived quality**: “the combination of product attributes which provide the greatest satisfaction to a specified user”.

- **Economic quality**: “a product that provides performance at an acceptable price, or conformance to requirements at an acceptable cost”.
In these terms, the first version model (i.e., user experience lifecycle with an acceptable system) is related to the fourth category of economic quality whereas the second one (i.e., the user experience lifecycle with an ‘adoptable’ system) is related to the category of user perceived quality implying a more user-centred approach.

4.2 Employing the user-experience lifecycle model for groups of systems

For the assessment of a set of systems offered by a single provider (or group of providers perceived by users as a single entity), the aforementioned models can be used to assess whether these are offered in a way that meets (acceptably or competitively) user needs and requirements. For instance, a user’s preferences (in terms of priorities) towards a list of the available products or services should be reflected in their comparative variances of ‘adoptability’, i.e., in their “visibility”, “perceived usefulness and ease of use”, and “availability and approachability”, “quality of usage experience”, and “relationship maintainability” induced from the design of each sub item.

5 Focusing on user interface accessibility and interaction experience

The proposed user experience lifecycle model can also be employed to predict or assess the quality of any subsystem, including individual functions of a system and their corresponding UIs. In other words, moving deeper into the evaluation of subsystems and system functions, the user experience lifecycle model is iteratively applied to each UI component. In other words, the same model proposed in section 3.1 for inspecting a system (e.g., a product or an (e)Service), can be employed (recursively) for assessing a subset of it, and in particular its UI, i.e., the overall quality of usage experience, including accessibility. Accessibility, in its broader sense, constitutes a critical factor, and is intended in the broader connotation of appropriate match between the user abilities, the characteristics of the context of use and of the access platform on the one hand, and the interaction facilities offered by a UI on the other hand (Savidis & Stephanidis, 2004). When focusing on the evaluation of a UI, the concept of accessibility replaces the term “availability/approachability”, as this is the established term when considering interaction with a UI. In practice, taking into account accessibility in the usage experience lifecycle of a product or service means assessing the possibility that each individual user group, with different characteristics and requirements, has to interact with the system both as a first experience and in the longer-term. To this purpose, the assessment process needs to be based on the identification of the users’ expectations and needs that are related to interaction and system usage, and on the integration of such characteristics as determinants for satisfying and acceptable access to various components of a UI.

In this perspective, a function of a computer-based system (e.g., of an eService) can be perceived as a system itself, and thereby be assessed in terms of:

- **Visibility to first time users.** This is related to the degree to which the UI design enables the user to become easily aware of the existence of a function.
- **Perceived usefulness, ease of access, ease of use, and risks to first time users prior using the function.** For example a function hidden behind a button needs clear icons, labels, and alt texts; and the manual of the system creates some positive or negative expectations to the user regarding the function’s ease of access, ease of use and entailed risks.
- **Accessibility.** Accessibility, in a proactive perspective, can be technically defined as “the existence, for each user task of an application or service, of a sequence of input actions and associated feedback, via accessible input / output devices, that leads to successful task accomplishment” (Savidis & Stephanidis, 2004).
- **Quality of interaction.** This is closely related to content and usability where usability can be defined as “the capability of all supported paths towards task accomplishment, to ‘maximally fit’ individual users’ needs and requirements in the particular context and situation of use” (ibid).
- **Relationship maintainability.** Sometimes, this attribute is also referred to as customer relationship management.
Focusing on repeated and long term use: The three levels of usage

Parallel studies based on empirical data (Antona, Mourouzis, Kartakis, & Stephanidis, 2005) have offered preliminary evidence that three types of usage levels can be identified suggesting that three corresponding life-cycle phases can be identified, and namely: “Exploration in width” (Level 1), which refers to the phase of the preliminary familiarization of the user with the interactive environment of a system, “Occasional (long term) use” (Level 2), which refers to the phase of common use of a system, and “Exploration in depth” (Level 3), which refers to the specialized usage (see Figure 2). The correspondence of usage levels with life-cycle phases has been based on the rationale that the performed analysis of the empirical data validates the initial assumption that demographics characteristics of the user population related to previous usage experiences, frequency and duration are correlated to different usage behaviour patterns and with different priorities over functional and non-functional requirements. After accessing (i.e., approaching) the system for the first time a (novice) user acquires (repeated) usage experience which can lead to (a) maintaining for some time an exploration in width usage pattern, or (b) adopting a more systematic / focused usage of the system, thus entering any of the subsequent phases occasional use and in depth exploration or (c) abandoning the idea of using the system.

Figure 2: The user experience lifecycle model reconsidered in the context of repeated and long term usage (from Antona et al, 2005)

The above three-phase lifecycle model suggests that user expectations and requirements regarding accessibility may also vary for each phase. For example, first time users may need to be provided adequate accessibility features for the support of independent (non assisted) learning of the system’s main functionality and interaction modes (e.g., navigation models), while in the subsequent phase, accessibility features need to be oriented towards supporting occasional and common use of the system by users with different abilities. Finally, in the third phase of more systematic use with higher levels of expectations, accessibility will also need to take into account issues of enhancing effectiveness and efficiency, and provide related means (e.g., through specialised functions and shortcuts).
On the other hand, in an evaluation perspective, the human factors that may determine accessibility breakdowns need to be considered as dynamic in the long-run (e.g., the user abilities may decrease over time). Such changes over time in terms of user abilities, as well as the usage phase changing presented above, appear to take place as a gradual process, and this remains to be further investigated empirically in future research, both in terms of accessibility and interaction quality.

7 Conclusions and Future Work

This paper is concerned with the determinants that can play a key role in the acceptance and ultimately long time adoption of computer systems. Particular attention is paid to taking into consideration accessibility as a necessary prerequisite, especially for diverse user populations and people with disability, to proceed into using and ultimately adopting a system. Towards this direction, a generic normative model has been elaborated in order to determine the various phases involved in the user’s experience lifecycle with a system, starting from the moment the user becomes aware of the system’s existence. The proposed model allows assessing a system in terms of its acceptability (i.e., the degree to which the systems’ perceived qualities foster or impede the user from using the system) as well as its ‘adoptability’ (i.e., the degree to which the perceived system qualities fulfil appropriately the user expectations and needs and inspire to the user a strong will to adopt the system and become a faithful user). Furthermore, the user experience lifecycle model can be applied iteratively for the evaluation of sub-modules and system functions, and thereby allowing to focus (at any desired level of depth) on the evaluation of the system UI components, both in terms of their accessibility and interaction quality.

Overall, the proposed model can serve as an evaluation framework that can apply both in systems that are aimed to offer Universal Access, including access to people with disability, as well as in systems that are specifically developed for disabled users.

Future work includes the validation of the proposed framework in evaluation experiments of web based services in general, and in particular of systems developed following a Design for All approach and of systems dedicated to disabled users. The applicability of the framework in order to drive both expert-based inspections and user-based studies will also be investigated. A paper-based method and tool for expert-based evaluations based on the proposed framework is currently under elaboration, and an online interactive version is also planned for future work. Finally, additional studies are required in order to further examine the issues involved when considering repeated system usage in the long run (see section 6), as well as their impact on the proposed framework.

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